

1 What is claimed is:

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3 1. A method of producing porous graphite, comprising the steps of:

4

5 introducing pitch into a mold, the pitch having a characteristic boiling point at a given pressure and

6 for a given temperature;

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8 purging air from the mold;

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10 pressurizing the pitch between a preselected initial processing pressure and a relatively lower final

11 processing pressure, the preselected initial pressure serving to increase the boiling point of the pitch

12 above the boiling point at the final processing pressure;

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14 heating the pitch while at the initial processing pressure to a temperature below the solidification

15 point but above the boiling point which typically occurs at the final processing pressure;

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17 depressurizing the pitch from the initial processing pressure to the final processing pressure while

18 maintaining the process temperature above the typical boiling temperature at the final pressure to

19 thereby produce a porous artifact;

20

21 heating the porous artifact to a temperature that solidifies and cokes the porous artifact to form a

22 solid, porous carbon; and

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24 cooling the solid, porous carbon artifact to room temperature with a simultaneous release of pressure.

25

26 heating the solid, porous carbon to a temperature between 900°C and 1100°C to completely

27 carbonize the artifact; and

1
2 heating the solid porous carbon artifact to a temperature between 2500°C and 3200°C to graphitize
3 the artifact thus producing a porous graphite artifact.
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5 2. The method of claim 1, wherein the pitch introduced into the mold is selected from the group
6 consisting of granulated pitches, powdered pitches and pelletized pitches.
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8 3. The method of claim 1, wherein the pitch is selected from the group consisting of mesophase and
9 isotropic pitches and mixtures thereof.
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11 4. The method of claim 3, wherein the pitch is a mesophase pitch selected from the group consisting
12 of synthetic pitches, coal based pitches, petroleum based pitches and mixtures thereof.
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14 5. The method of claim 1, wherein the initial processing pressure is greater than 1000 psi.
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16 6. The method of claim 1, wherein the initial processing pressure is more than twice the final
17 processing pressure.
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19 7. The method of claim 1, wherein the final processing pressure is greater than 1000 psi.
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21 8. A method of producing solid, high thermally conductive porous graphite, comprising the steps
22 of:
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24 introducing pitch into a mold, the pitch having a characteristic boiling point at a given pressure and
25 for a given temperature;
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27 purging air from the mold;

1 pressurizing the pitch between a preselected initial processing pressure and a relatively lower final
2 processing pressure, the preselected initial pressure serving to increase the boiling point of the pitch
3 above the boiling point at the final processing pressure;

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5 heating the pitch while at the initial processing pressure to a temperature below the solidification
6 point but above the boiling point which typically occurs at the final processing pressure;

7
8 depressurizing the pitch from the initial processing pressure to the final processing pressure while
9 maintaining the process temperature above the typical boiling temperature at the final pressure to
10 thereby produce a porous artifact;

11 heating the porous artifact to a temperature that solidifies and cokes the porous artifact to form a
12 solid, porous carbon; and

13
14 cooling the solid, porous carbon artifact to room temperature with simultaneous release of pressure;
15 heating the solid, porous carbon to a temperature between 900°C and 1100°C to completely
16 carbonize the artifact; and

17
18 heating the solid porous artifact to a temperature between 2500°C and 3200°C to graphitize the
19 artifact thus producing a porous graphite artifact having a thermal conductivity greater than about
20 150 W/mK and a density greater than foam.

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22 9. The method of claim 8, wherein the initial processing pressure is greater than 1000 psi.

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24 10. The method of claim 8, wherein the initial processing pressure is more than twice the final
25 processing pressure.

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27 11. The method of claim 8, wherein the final processing pressure is greater than 1000 psi.

1 12. The method of claim 8, wherein the initial processing pressure is selected to be at least 8000 psi.

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3 13. The method of claim 8, wherein the final processing pressure is selected to be at least 2000 psi.

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5 14. The method of claim 8, wherein the porous graphite artifact so produced has a density greater
6 than 0.678g/cc.

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8 15. The method of claim 8, wherein the porous graphite artifact so produced has a thermal
9 conductivity greater than 200 W/mK.

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11 16. The method of claim 8, wherein the mold is pressurized in a vessel to an initial pressure between
12 4,000 to 30,000 psig with an inert gas.

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14 17. The method of claim 16, wherein the pitch within the mold is heated from room temperature to
15 a melting temperature between 250 and 350°C at a rate between 1.0 and 10.0°C per minute.

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17 18. The method of claim 17, wherein the pitch is then held between 250 and 450°C for up to 4
18 hours.

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20 19. The method of claim 18, wherein the vessel is depressurized from the initial processing pressure
21 to the final processing pressure at a rate between 50 and 700 psig per minute while maintaining the
22 pre-depressurization temperature.

23
24 20. The method of claim 19, wherein, after depressurization, the porous artifact is heated from the
25 pre-depressurization temperature to a temperature between 400 and 800°C at a rate between 1.0 and
26 10.0°C per minute.

- 1 21. The method of claim 20, wherein the artifact is held between 400 and 800°C for up to 4 hours.
- 2
- 3 22. The method of claim 21, wherein the artifact is cooled from between 400 and 800°C to room
- 4 temperature at a rate between 1.0 and 30°C per minute.
- 5
- 6 23. A solid, high thermally conductive porous graphite having a thermal conductivity greater than
- 7 150 W/mK and a density greater than 0.678g/cc.
- 8
- 9 24. A solid, high thermally conductive porous graphite having a thermal conductivity greater than
- 10 150 W/mK and a density greater than a graphite foam.
- 11
- 12 25. A solid, high thermally conductive porous graphite having a thermal conductivity greater than
- 13 150 W/mK and having a density which ranges between 0.678g/cc and 1.5g/cc.
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